

The Food of the Imperial Eagle (*Aquila heliaca*) in Slovakia

Potrava orla kráľovského (*Aquila heliaca*) na Slovensku

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Abstract: In this work we assess the data on the food of the Imperial Eagle (*Aquila heliaca*) in two separate nesting populations: one in Western Slovakia (21 pairs), the other in Eastern Slovakia (30 pairs). In Western Slovakia between 1978 and 2005 we recorded a total of 562 food items, consisting of 33 species of animal. The species predominantly featuring in the food were the brown hare *Lepus europaeus* (40.2%), common pheasant *Phasianus colchicus* (17.3%), feral pigeon *Columba livia domestica* (11.7%) and the common hamster *Cricetus cricetus* (11.6%). In Eastern Slovakia between 1971 and 2005 we identified a total of 524 food items, made up of 30 animal species with slightly varying predominance of the same principal kinds of prey: *L. europaeus* (29.0%), *C. cricetus* (27.7%), *P. colchicus* (8.4%) and *Columba* sp. (8.2%). Imperial Eagles nesting in Slovakia are affected by the consequences of a marked reduction in population density of steppe-type rodents, especially ground squirrels (*Spermophilus citellus*) and hamsters (*C. cricetus*) and have become dependent for their food mainly on the prevalence of other small animals (*L. europaeus*, *P. colchicus*) and pigeons (*C. livia domestica*). Pairs nesting in neighbouring Hungary had similar prey, but a different order of predominance of the species (Haraszthy et al. 1996): *C. cricetus* (51.0%), *L. europaeus* (12.0%), *P. colchicus* (11.6%) and *S. citellus* (7.4%).

Abstrakt: V práci sme vyhodnotili údaje o potrave orla kráľovského (*Aquila heliaca*) dvoch oddelených hniezdných populácií: na západnom Slovensku (21 párov) a východnom Slovensku (30 párov). Na západnom Slovensku sme od roku 1978 do roku 2005 zistili spolu 562 kusov potravy, ktorú tvorilo 33 druhov živočíchov. Dominantne sú v potrave zastúpené druhy *Lepus europaeus* (40,2 %), *Phasianus colchicus* (17,3 %), *Columba livia domestica* (11,7 %) a *Cricetus cricetus* (11,6 %). Na východnom Slovensku sme od roku 1971 do roku 2005 zistili spolu 524 kusov potravy, ktorú tvorilo 30 druhov živočíchov s odlišnou dominanciou hlavných druhov koristi: *L. europaeus* (29,0 %), *C. cricetus* (27,7 %), *P. colchicus* (8,4 %) a *Columba* sp. (8,2 %). *A. heliaca* hniezdiace na Slovensku v dôsledku výrazného poklesu denzity stepných druhov hlodavcov, najmä *Spermophilus citellus* a *C. cricetus* sú potravne závislé predovšetkým na početnosti drobnej zveri (*L. europaeus*, *P. colchicus*) a holubov (*C. livia domestica*). Páry hniezdiace v susednom Maďarsku mali odlišné poradie dominantných druhov (Haraszthy et al. 1996): *C. cricetus* (51,0 %), *L. europaeus* (12,0 %), *P. colchicus* (11,6 %) a *S. citellus* (7,4 %).

Key words: Imperial Eagle, *Aquila heliaca*, food, Slovakia

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Introduction

The Carpathian Basin is an area featuring a partially-isolated population of Imperial Eagles nesting in the territories of Slovakia, Hungary and northern Serbia, while the boundary of their occurrence has extended in recent years into the Czech Republic and Austria. This area forms the north-western part of their total nesting area in Europe. This species most probably started nesting in Slovakia around the 1940's, and details of their progressive occupying of suitable nesting biotopes in both western and eastern Slovakia have been published. So far nobody has systematically studied the food of Imperial Eagles in Slovakia, and until recently there was a lack of similar data from Hungary as well. The causes of the expansion of the eagles' area of occurrence in Central Europe were studied by Sládek (1959), who also published some initial data regarding their food.

Methods

We gathered basic data on the prey of Imperial Eagles in two ways:

1. visual identification of species of captured animals during direct observation of nests,
2. identification of remains of prey collected from nests or their environs.

Remains of food were collected from nests during inspection for the purpose of ringing young birds, or after the young had left the nest. Part of the analyzed food remains consisted of items found below the nests or under the pairs' resting perches in the vicinity of the nests. These data were then summarized based on nesting pairs and individual seasons. Since some of the data were insufficiently representative, we proceeded to combine data from pairs nesting in the same orographic zone (Tables 1 and 3), and we linked seasons into five-year intervals (pentades, Tables 2 and 4). We assessed the food spectrum of *Aquila heliaca* using the method of seeking marked differences from the mean (MDFM, Obuch 2001). Distinct positive (+) and negative (-) deviations are shown in the contingency Tables 1 to 4, in which the prey types are ordered according to the customary zoological system. In Table 5 the diagnostic species are arranged into blocks with positive (+) MDFM, and other species are arranged according to decreasing prevalence.

Influences on the favourable state of hunting (feeding) territories

Imperial Eagles in Slovakia are specifically associated with the agricultural landscape, and for hunting they make use of the biotopes of lowland areas and the surrounding hills – typical cultivated environments. An exception still found in recent years consisted of pairs nesting in the Slovak Karst, hunting ground squirrels on the karst plateaux themselves. The diversity and availability of sources of food are influenced primarily by the human agricultural and game hunting usages of the countryside in which the eagles' hunting-grounds are located.

1. Agricultural usage

The range of foodstuffs and availability of food sources depend on the standard of agricultural environments achieved, their structure and character. During the spring, at the beginning of the vegetational period, hunting is more simple, but at this time of year food is only required for old pairs of eagles. While the young are being reared the countryside changes, and thus also the availability of prey which the parents need to catch in greater measure because of their hungry offspring. Environments which are practically unsuitable for hunting include for example tall maize or tobacco fields. In contrast the type of growth that is amenable includes alfalfa, lentils, and kinds of cereals with stem height not exceeding 60 cm. The structure and diversity of crops in the hunting territory have an important influence on the development of diversity and numbers of particular animal species. The conditions of Imperial Eagles' hunting-grounds in Slovakia are characterized by large-scale agricultural management, with individual monoculture plot areas ranging on average from 60 to 300 hectares. As a result of the intention to achieve the highest possible cereals production, during the period 1950 to 1970 water-logged fields were drained, boundaries were ploughed up, and woody thickets as well as solitary old trees were removed. The merging of smaller plots in the interests of creating extensive fields for more economical land management led to a marked change in the countryside, especially in terms of reduced variety in vegetation structure and a generally unfavourable impact on biodiversity. There was a particularly negative effect from the application of chemical substances in fertilizers, and there is currently still a significant threat mainly from the use of pesticides to eliminate small, ground mammals, especially rodents. On the other hand, there are clearly favourable consequences from the harvesting of food crops, which leads to significant numbers of animals

being killed, and these are often picked up by the eagles, especially from May onwards during the second half of their nesting period.

In contrast, summer and autumn ploughing has a definitely negative impact on the numbers of two important species of prey, the field hamster (*C. cricetus*) and the common vole (*Microtus arvalis*), precisely at the time when fully-reared young eagles fly into the hunting-grounds and begin hunting for themselves.

In spite of these circumstances it is nevertheless evident that Imperial Eagles have adapted to the current conditions. This is demonstrated by the good productivity of individual pairs and the constant increase in population numbers, which at the present time stand at 41 pairs within the whole territory of Slovakia (the counting included pairs in older nesting sites which have become disused in the meantime, so the number of monitored pairs quoted in the abstract and subsequently in this paper is actually higher).

The decisive factors for the availability of food sources in agriculturally-managed countryside are:

- the structure and proportions of appropriate kinds of crops planted, which create the biotope for key species of prey
- the cutting of perennial food crops, especially alfalfa, which creates opportunities for successful hunting or picking up of killed or wounded animals

- cereals harvesting, because the period following the young birds' flying from the nest and their introduction to the hunting-grounds provides important opportunities for hunting animals over extensive areas stripped of vegetation.

2. Game hunting usage

In Slovakia until around 1990 Imperial Eagles nested almost exclusively in upland areas. We assume that one of the principal factors for this upland nesting was the forcing of the raptors out of the lowlands, partly as a result of the exercising of hunting interests.

Game hunting in the eagles' hunting-grounds, including in many instances the illegal shooting of raptors, represents a significant negative factor. In our view, however, there appear to have been some positive changes in this respect, because since 1990 individual pairs have started nesting in the lowlands with increasing frequency, that is within their own hunting grounds. In Slovakia in 2005 up to 58% of pairs made their nests in lowland farming areas, while 42% nested in the hills.

In the interests of improving the favourable situation with regard to hunting grounds, it will be necessary to find a compromise between game-hunting usage and respecting the feeding requirements of Imperial Eagles as one of the most threatened species of eagle in Europe. The results of our study of the range of prey caught by these eagles

show in fact that their scant population in this country can in no relevant way threaten the interests or the role of game-hunting in the countryside, while the eagles' presence in the ecosystem on the other hand is of indispensable significance. In the period up to 1989 there was another unfavourable influence on the availability of food resulting from the mass killing of field hamsters (*C. cricetus*) by people intending to sell their skins.

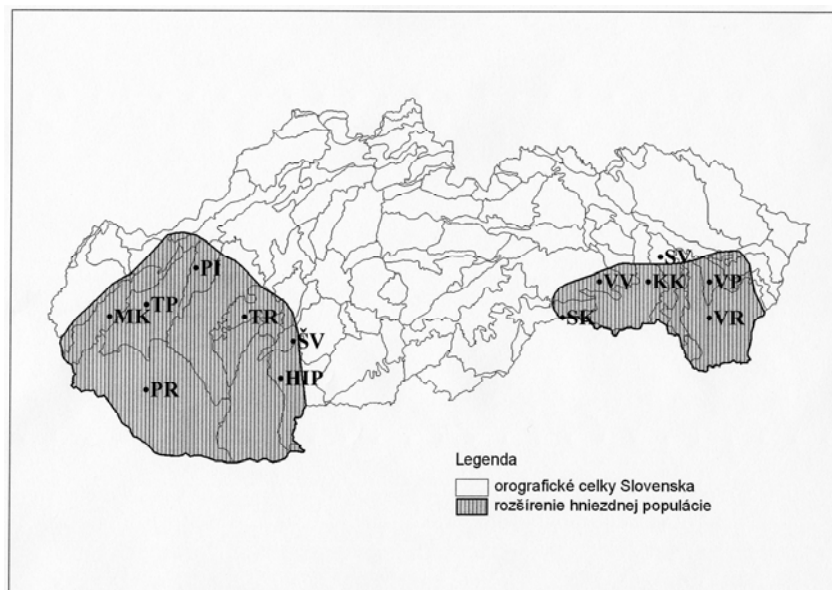


Fig. 1. Map showing the extent of nesting by Imperial Eagles in Slovakia. □ - orographic zones of Slovakia

Obr. 1. Mapa hniezdneho rozšírenia orla kráľovského na Slovensku. □ - orografické celky Slovenska

Results

A. Western Slovakia, Tables 1 and 2

In Western Slovakia we have been systematically monitoring the prey of *A. heliaca* since 1978 using a combined method of observing prey brought to nests and collecting remains for osteological identification.

Up to 2005 we acquired data on 562 items of prey. The predominant component consisted of mammals (Mammalia, 60.3%, 11 species). Birds were represented in lower numbers but greater diversity (Aves, 39.7%, 22 species). We evaluated material from 21 nesting pairs, whereby the most intensively monitored was the food of six pairs of *A. heliaca* nesting in the Little Carpathians. Comparing the food of individual nesting pairs, but also after cumulating the data based on orographic zones (see Table 1), we find marked similarity in the proportions of the food spectra represented, with only small deviations from the summary mean values. Most probably this is a result of the tendency of pairs nesting in the hills to hunt in adjacent farmland areas, just like the pairs nesting directly within these areas.

The predominant prey of *A. heliaca* in Western Slovakia is the brown hare (*Lepus europaeus*) 40.2%, mainly young animals with low body weight), followed by common pheasant (*Phasianus colchicus*) 17.3%, mainly younger birds or hens; no remains of cock birds were found, pigeons (*Columba livia domestica*) 11.7% and field hamsters (*Crictus cricetus*) 11.6%. Species found in lesser numbers in the food of *A. heliaca* were: magpie (*Pica pica*) 2.3%, roe deer (*Capreolus capreolus*) 2.1%, common vole (*Microtus arvalis*) 2.0%, ground squirrel (*Spermophilus citellus*) 1.6%, grey partridge (*Perdix perdix*) 1.6%, long-eared owl (*Asio otus*) 1.1%, wild mallard (*Anas platyrhynchos*) 1.1% and East European hedgehog (*Erinaceus concolor*) 1.1%. Other species (Mammalia, 5 species, Aves, 16 species) are chance prey for *A. heliaca* with occurrences below 1%. A markedly greater affinity for hunting magpies (*P. pica*) was found in one pair of *A. heliaca* on the Danube Plain. Ground squirrels (*S. citellus*) were hunted by only two pairs from the Little Carpathians, while hamsters (*C. cricetus*) were hunted in greater numbers by pairs from the Považský Inovec hills. There is also a relative balance in the kinds of prey when the data are evaluated season by season (Table 2). Only pheasants (*P. colchicus*) were hunted more frequently during the first phase of

monitoring (till the late 1980's), ground squirrels (*S. citellus*) in the late 1990's, and hamsters (*C. cricetus*) and magpies (*P. pica*) in the most recent years.

B. Eastern Slovakia, Tables 3 and 4

We have been monitoring the feeding of *A. heliaca* in the East Slovakian nesting grounds since 1970. Data are based mainly on observation of food items brought to nests, and of successful attacks on prey.

In the data on 524 food items collected up to the year 2005, mammals are more numerous (Mammalia, 71.4%, 13 species) than birds (Aves, 28.2%, 15 species). There were also rare findings of reptiles (Serpentes, 1 ex.) and fish (Pisces, 1 ex.).

The predominant species making up the food of *A. heliaca* are the brown hare (*L. europaeus*) 29.0% and field hamster (*C. cricetus*) 27.7%. The next most numerous prey are the common pheasant (*P. colchicus*) 8.4%, pigeons (*Columba* sp.) 8.2% and ground squirrel (*S. citellus*) 6.3%. Less common items of the eagles' food are the domestic hen (*Gallus gallus domestica*) 4.0%, rook (*Corvus frugilegus*) 2.7%, common vole (*M. arvalis*) 2.1%, raven (*Corvus corax*) 1.3% and domestic cat (*Felis catus domestica*) 1.2%. Other prey (Mammalia, 8 species, Aves, 12 species, Serpentes and Pisces) are represented in the food of *A. heliaca* with less than 1% incidence.

Ground squirrels (*S. citellus*) were hunted mainly by pairs nesting in the Slovakian Karst and the Košice Basin, although pairs nesting in the Volovské Hills also hunted them in these two orographic zones. Ground squirrels featured more frequently in the eagles' food in the early 1980's, but they have also been found occasionally in more recent years. Higher incidence of hamsters (*C. cricetus*) in the early 1970's and in the last five years is assumed to be linked with their long-term population cycles.

We found three nesting pairs specializing in hunting hamsters: one pair from the Volovské Hills and another from the Slanské Hills hunted them in the Košice Basin, and the third pair hunted them on the East Slovakian Plain. Field voles (*M. arvalis*) were found to be more numerous in the food of one nesting pair in the Košice Basin, and there was an interesting finding of at least two ravens (*C. corax*) in the nest of one pair in the Slanské Hills in 2005. This pair evidently specializes in ravens, since we also found them in the eagles' food in preceding years, namely 1996, 1997 and 2001.

A. Western Slovakia, Tables 1 and 2

Tab. 1. Western Slovakia, evaluation of data on the food of *A. heliaca* based on location of nests in orographic zones.

Tab. 1. Západné Slovensko, vyhodnotenie dát o potrave *A. heliaca* podľa umiestnenia hniezdisk v orografických celkoch.

Species/Orographic zones	MK	PR	TP	PI	TR	ŠV	HIP	Suma	%
<i>Erinaceus concolor</i>	5					1		6	1.07
<i>Lepus europaeus</i>	147	8	10	31	9	-10	11	226	40.21
<i>Spermophilus citellus</i>	9							9	1.60
<i>Rattus norvegicus</i>	2							2	0.36
<i>Cricetus cricetus</i>	41	1	3	+16	3	-0	1	65	11.57
<i>Ondatra zibethicus</i>	1							1	0.18
<i>Microtus arvalis</i>	4			5	1	1		11	1.96
<i>Felis catus dom.</i>	4							4	0.71
<i>Sus scrofa</i>				1				1	0.18
<i>Capreolus capreolus</i>	8			1		2	1	12	2.14
<i>Ovis musimon</i>	2							2	0.36
Mammalia	223	9	13	54	13	-14	13	339	60.32
<i>Anas platyrhynchos</i>	5			1				6	1.07
<i>Buteo buteo</i>	1						1	2	0.36
<i>Falco tinnunculus</i>						1		1	0.18
<i>Perdix perdix</i>	6			2		1		9	1.60
<i>Coturnix coturnix</i>					1	1	1	3	0.53
<i>Phasianus colchicus</i>	72	2	1	1-7	4	8	3	97	17.26
<i>Gallus gallus dom.</i>						1		1	0.18
<i>Meleagris gallopavo dom.</i>						1		1	0.18
<i>Vanellus vanellus</i>	1							1	0.18
<i>Larus ridibundus</i>				1				1	0.18
<i>Columba livia dom.</i>	42	3	2	12		6	1	66	11.74
<i>Columba palumbus</i>						1		1	0.18
<i>Streptopelia decaocto</i>	1							1	0.18
<i>Asio otus</i>	4			2				6	1.07
<i>Strix aluco</i>	2							2	0.36
<i>Lullula arborea</i>						1		1	0.18
<i>Coccothraustes coccothr.</i>	1							1	0.18
<i>Sturnus vulgaris</i>	1							1	0.18
<i>Pica pica</i>	-1	+8		2		2		13	2.31
<i>Corvus corax</i>							1	1	0.18
<i>Corvus frugilegus</i>	2			1		3		6	1.07
<i>Corvus corone</i>	1		1					2	0.36
Aves	140	13	4	28	5	+26	7	223	39.68
Total	363	22	17	82	18	40	20	562	100.00
H' diversity index	1.94	1.37	1.20	1.89	1.30	2.28	1.51	2.05	

Key:

Orographic zones: MK – Little Carpathians, PR – Danube Plain, TP – Trnava Hills, PI – Považský Inovec, TR – Tribeč, ŠV – Štiavnica Hills, HIP – Hron and Ipeľ Hills
 +, - : positive and negative deviations from mean values (Obuch 2001)

Vysvetlivky:

Orografický celok: MK – Malé Karpaty, PR – Podunajská rovina, TP – Trnavská pahorkatina, PI – Považský Inovec, TR – Tribeč, ŠV – Štiavnické vrchy, HIP – Hronská a Ipeľská pahorkatina
 +, - : kladné a záporné odchýlky od priemeru (Obuch 2001)

Tab. 2. Western Slovakia, summarization of data on the food of *A. heliaca* into five-year periods (pentads).

Tab. 2. Západné Slovensko, zlučenie dát o potrave *A. heliaca* do päťročných období (pentád).

Species \ Pentads	78-79	80-84	85-89	90-94	95-99	00-04	2005	Suma	%
<i>Erinaceus concolor</i>		2	2	1		1		6	1.07
<i>Lepus europaeus</i>	16	35	44	28	16	73	14	226	40.21
<i>Spermophilus citellus</i>			1		+ 8			9	1.60
<i>Rattus norvegicus</i>		2						2	0.36
<i>Cricetus cricetus</i>	2	7	11	3	5	+ 30	7	65	11.57
<i>Ondatra zibethicus</i>							1	1	0.18
<i>Microtus arvalis</i>		4		2	3		2	11	1.96
<i>Felis catus dom.</i>		1				1	2	4	0.71
<i>Sus scrofa</i>						1		1	0.18
<i>Capreolus capreolus</i>		1	6	1		3	1	12	2.14
<i>Ovis musimon</i>				2				2	0.36
Mammalia	18	52	64	37	32	109	27	339	60.32
<i>Anas platyrhynchos</i>			3	2			1	6	1.07
<i>Buteo buteo</i>						1	1	2	0.36
<i>Falco tinnunculus</i>						1		1	0.18
<i>Perdix perdix</i>	2	4				3		9	1.60
<i>Coturnix coturnix</i>						3		3	0.53
<i>Phasianus colchicus</i>	+ 14	+ 25	18	8	8	- 19	5	97	17.26
<i>Gallus gallus dom.</i>						1		1	0.18
<i>Meleagris gallopavo dom.</i>						1		1	0.18
<i>Vanellus vanellus</i>			1					1	0.18
<i>Larus ridibundus</i>							1	1	0.18
<i>Columba livia dom.</i>	3	13	8	7	8	22	5	66	11.74
<i>Columba palumbus</i>						1		1	0.18
<i>Streptopelia decaocto</i>			1					1	0.18
<i>Asio otus</i>	1	1	2			2		6	1.07
<i>Strix aluco</i>				2				2	0.36
<i>Lullula arborea</i>						1		1	0.18
<i>Coccothraustes coccothr.</i>						1		1	0.18
<i>Sturnus vulgaris</i>				1				1	0.18
<i>Pica pica</i>			1			+ 11	1	13	2.31
<i>Corvus corax</i>							1	1	0.18
<i>Corvus frugilegus</i>			1	1		3	1	6	1.07
<i>Corvus corone</i>					1	1		2	0.36
Aves	20	43	35	21	17	71	16	223	39.68
Total	38	95	99	58	49	180	43	562	100.00
H' diversity index	1.34	1.76	1.78	1.78	1.74	1.97	2.15	2.05	

Key:

+, - : positive and negative deviations from the mean value (Obuch 2001)

Vysvetlivky:

+, - : kladné a záporné odchýlky od priemeru (Obuch 2001)

B. Eastern Slovakia, Tables 3 and 4

Tab. 3. Eastern Slovakia, evaluation of data on the food of *A. heliaca* based on location of nests in orographic zones.
Tab. 3. Východné Slovensko, vyhodnotenie dát o potrave *A. heliaca* podľa umiestnenia hniezdisk v orografických celkoch.

Species/Orographic zones	SK	VV	KK	SV	ZV	VP	VR	Suma	%
<i>Erinaceus concolor</i>				2			1	3	0.57
<i>Talpa europaea</i>						1		1	0.19
<i>Lepus europaeus</i>		- 10	- 8	63	10	15	46	152	29.01
<i>Spermophilus citellus</i>	+ 5	+ 10	+ 15	- 2	1		- 0	33	6.30
<i>Rattus norvegicus</i>			1	4				5	0.95
<i>Cricetus cricetus</i>		24	16	51	7	- 2	45	145	27.67
<i>Ondatra zibethicus</i>				1				1	0.19
<i>Microtus arvalis</i>			+ 7	4				11	2.10
<i>Canis lupus fam.</i>	2							2	0.38
<i>Mustela nivalis</i>				2				2	0.38
<i>Felis catus dom.</i>			4	1		1		6	1.15
<i>Sus scrofa</i>				1			2	3	0.57
<i>Capreolus capreolus</i>		4		3			3	10	1.91
Mammalia	7	48	51	134	18	19	97	374	71.37
<i>Anas platyrhynchos</i>							3	3	0.57
<i>Anas platyrhynchos dom.</i>				1				1	0.19
<i>Phasianus colchicus</i>		- 0	3	15	5	6	15	44	8.40
<i>Gallus gallus dom.</i>	1	3	1	11	1	2	2	21	4.01
<i>Meleagris gallopavo dom.</i>				1				1	0.19
<i>Vanellus vanellus</i>			1					1	0.19
<i>Columba livia dom.</i>		+ 8	3	6	3		3	23	4.39
<i>Columba sp.</i>		1		13		2	4	20	3.82
<i>Cuculus canorus</i>				1				1	0.19
<i>Asio otus</i>				1				1	0.19
<i>Strix uralensis</i>				1				1	0.19
<i>Turdus sp.</i>				1				1	0.19
<i>Pica pica</i>				1		2		3	0.57
<i>Corvus corax</i>				7				7	1.34
<i>Corvus frugilegus</i>			1	6	4	1	2	14	2.67
<i>Corvus corone</i>				2				2	0.38
Passeriformes sp.				1				1	0.19
Aves sp.		2		1				3	0.57
Aves	1	14	- 9	69	13	13	29	148	28.24
Serpentes sp.	1							1	0.19
Pisces sp.	1							1	0.19
Total	10	62	60	203	31	32	126	524	100.00
H' diversity index	1.36	1.72	1.97	2.27	1.71	1.69	1.60	2.25	

Key:

Orographic zones: SK – Slovakian Karst, VV – Volovské Hills, KK – Košice Basin, SV – Slanské Hills, ZV – Zemplínske Hills, VP – East Slovakian Hills, VR – East Slovakian Plain
 +, - : positive and negative deviations from the mean value (Obuch 2001)

Vysvetlivky:

Orografický celok: SK – Slovenský kras, VV – Volovské vrchy, KK – Košická kotlina, SV – Slanské vrchy, ZV – Zemplínske vrchy, VP – Východoslovenská pahorkatina, VR – Východoslovenská rovina
 +, - : kladné a záporné odchýlky od priemeru (Obuch 2001)

Tab. 4. Eastern Slovakia, summarization of data on the food of *A. heliaca* into five-year periods (pentads).

Tab. 4. Východné Slovensko, zúčenie dát o potrave *A. heliaca* do päťročných cyklov (pentád).

Species \ Pentads	70-74	75-79	80-84	85-89	90-94	95-99	00-04	2005	Suma	%
<i>Erinaceus concolor</i>	1				1		1		3	0.57
<i>Talpa europaea</i>			1						1	0.19
<i>Lepus europaeus</i>	13	9	6	11	13	39	44	17	152	29.01
<i>Spermophilus citellus</i>	3		+ 10		4	14	- 2		33	6.30
<i>Rattus norvegicus</i>	1	1				2	1		5	0.95
<i>Cricetus cricetus</i>	+ 23	6	- 0	10	18	31	+ 46	11	145	27.67
<i>Ondatra zibethicus</i>	1								1	0.19
<i>Microtus arvalis</i>	1		3			7			11	2.10
<i>Canis lupus fam.</i>					1	1			2	0.38
<i>Mustela nivalis</i>	2								2	0.38
<i>Felis catus dom.</i>						4	2		6	1.15
<i>Sus scrofa</i>						1	2		3	0.57
<i>Capreolus capreolus</i>					3	3	1	3	10	1.91
Mammalia	45	16	20	21	40	102	99	31	374	71.37
<i>Anas platyrhynchos</i>							2	1	3	0.57
<i>Anas platyrhynchos dom.</i>						1			1	0.19
<i>Phasianus colchicus</i>	3	5			6	10	11	9	44	8.40
<i>Gallus gallus dom.</i>			2	5	3	6	5		21	4.01
<i>Meleagris gallopavo dom.</i>					1				1	0.19
<i>Vanellus vanellus</i>						1			1	0.19
<i>Columba livia dom.</i>			1	+ 6	6	7	3		23	4.39
<i>Columba sp.</i>		5		1		8	1	5	20	3.82
<i>Cuculus canorus</i>								1	1	0.19
<i>Asio otus</i>								1	1	0.19
<i>Strix uralensis</i>							1		1	0.19
<i>Turdus sp.</i>		1							1	0.19
<i>Pica pica</i>		1			1			1	3	0.57
<i>Corvus corax</i>					1	3	1	2	7	1.34
<i>Corvus frugilegus</i>				2	6	2	2	2	14	2.67
<i>Corvus corone</i>		1		1					2	0.38
Passeriformes sp.	1								1	0.19
Aves sp.		1			1	1			3	0.57
Aves	- 4	14	3	15	25	39	- 26	+ 22	148	28.24
Serpentes sp.	1								1	0.19
Pisces sp.					1				1	0.19
Total	50	30	23	36	66	141	125	53	524	100.00
H' diversity index	1.64	1.85	1.46	1.65	2.22	2.26	1.73	1.92	2.25	

Key:

+, - : positive and negative deviations from the mean value (Obuch 2001)

Vysvetlivky:

+, - : kladné a záporné odchýlky od priemeru (Obuch 2001)

Discussion

The first raw data on the food of Imperial Eagles in Slovakia were from the 1950's, published by Sládek (1959). A nesting site up at Tribeč revealed remains of hamsters, ground squirrels, young hares, feral pigeons and unspecified reptiles. Remains of hares, stock doves and collared doves were found at a nesting site up at Inovec, and a nest in the Little Carpathians contained parts of two young hares, a partridge and a hen pheasant. In the Košice Basin an eagle was observed hunting ground squirrels. Mošanský (1956) found the beak and bones of a partridge in the stomach of an adult eagle. Information on the feeding of young buzzards in the nest was provided by Harvančík and Šnirer (1987). Part of the data published by Danko (1973) is used in this article. However, we have not found any other data on the food of Imperial Eagles in Slovakia in the literature. In Southern Moravia Horák (1998, 2000) found 5 hamsters, 3 young hares, one ermine and one other young rodent in eagles' nests.

The principal ways of hunting prey and acquiring food among Imperial Eagles are:

- attacking spotted prey from passing or circling flight,
- attacking spotted prey from perches in elevated locations,
- hunting wounded animals or collecting carrion
- kleptoparasitism
- snatching other birds' young from their nests

A surprisingly high proportion of pigeons (*C. livia dom.*) 11.7 % was found in the food of Imperial Eagles in Western Slovakia.

We observed two ways of acquiring this kind of prey:

1. Kleptoparasitism, in which the eagles steal prey from other raptors (falcons, hawks) by attacking an individual bird of another species either carrying prey in passing flight, or tearing at the prey on the ground. After some pursuit the attacked bird usually releases the prey in the interests of its own safety, and the eagle then takes it. For more details about kleptoparasitism by *A. heliaca*, see the article by Danko and Mihók on pages 29-33 of this edition of the journal.

2. Active hunting of pigeons, which has been observed on at least four occasions at M. R. Štefánik Airport in Bratislava. An eagle dropped from a height to attack a large flock of pigeons (*C. livia*

dom.) feeding in low vegetation or stubble. It then took advantage of the confusion among the flying-up birds and usually caught a pigeon in the air between 10 to 20 metres above the ground (Šarvari in verb.). We have observed an eagle catching a lapwing (*Vanellus vanellus*) in a similar way, dropping to the ground from a great height about 70 metres away from where a group of lapwings were sitting, but then continuing the attack at high speed just above the ground, making use of the surprise factor to successfully catch the substantially more agile prey.

The common vole (*M. arvalis*) is of special significance in the food of *A. heliaca*. It apparently makes up only a small part of the collected samples (around 2%), but demonstrating its true proportion is complicated by two factors. The first is the fact that the eagles hunt voles mainly outside of the nesting season, so remains are rarely found in nests, and the second is that they are almost completely digested in the eagle's stomach, so that insufficient remains of bones are left to be found in regurgitations. Eagles most commonly hunt voles from observation perches (trees, high bushes, haystacks), or by taking off from the ground and then flying in from a reduced height (between 20 to 50 metres). In late summer 2005, around 60 days after flying from the nest, a young *A. heliaca* was observed hunting voles in alfalfa stubble in the presence of an adult female (mother). It took off from the ground, flew up several metres (2 – 10 m) and then dropped obliquely onto the vole it had spotted. In this way the young eagle was able to catch new prey several times in succession, because at that time there was an unusually large population of voles in that place (Izakovič in verb.).

In the Čunovo area near Bratislava a juvenile Imperial Eagle was observed trying to hunt down an isolated and evidently not flying (probably shot down) bean goose (*Anser fabalis*). When the eagle attacked, the goose stretched out its neck and launched itself hissing at the raptor. After five or six repeatedly unsuccessful attacks, the eagle finally gave up and flew away.

Evidently a frequent way of gaining food for the eagles is to collect up any injured animals or carcasses which they find. In Eastern Slovakia some pairs have been artificially fed by people laying out carcasses for them (*F. catus dom.*, *C. cricetus*, *Eri-naceus concolor*, *C. livia dom.*).

Another way of acquiring prey is to snatch the young of other bird species from their nests, or to hunt them in the vicinity of their nests. This fact is most frequently documented by finds of young mag-

pies (*P. pica*). In the nest of a pair of eagles in Western Slovakia, on a single inspection we found the remains of as many as 5 young magpies. In other pairs' nests we have found the young of species such as *C. frugilegus*, *C. corax*, *V. vanellus*, *Strix aluco*, *Asio otus*, *Buteo buteo* and *Falco tinnunculus*. Another very interesting find was remains of a young woodlark (*Lullula arborea*) in an eagles' nest in the Štiavnické Hills (see Fig. 11).

In the cases of finds of ungulates such as roe deer (*Capreolus capreolus*), mouflon (*Ovis musimon*) and wild pig (*Sus scrofa*), these were exclusively less than week-old young, or parts of their bodies which the eagles had most probably found as carcasses after mowing, although the possibility of their having been hunted should not be ruled out either. In the case of the pigs, in fact, we have no confirmation of whether they were domestic or wild. Some of the species of animals and birds may have been instances of carcasses thrown away by people. Collisions of eagles with road vehicles or trains indicate that their prey could also consist of road-kill or rail-kill victims picked up from the ground.

Pairs nesting in the hills evidently also make use of opportunities for hunting other birds in the vicinity of their nests, as demonstrated by finds of captured species such as tawny and ural owls (*Strix aluco* and *S. uralensis*).

Based on finds of prey in eagles' nests, the maximum weight of an individual catch was estimated at up to 1.4 kg. Remains of larger and heavier animals probably come from carcasses found by eagles and carried to their nests in pieces, but in any case these were isolated cases. Adult eagles sometimes bring prey to the nest without the head, or already partly consumed. One instance was observed of an eagle in flight eating the head and upper body of a ground squirrel (*S. citellus*) it had caught.

Food of *A. heliaca* in the Pannonian Basin, Table. 5

Despite the tradition of systematic observation of eagles in Hungary, almost no data regarding their food have been published there. Tapfer (1973) mentions that according to his observations in the 1960's eagles hunted 60-70% ground squirrels and 20-25% hamsters. On rare occasions he found young hares or carcasses, in one case of a young domestic duck. Bécsy (1974) observed one eagles' nest in 1971-72 and found 8 hamsters, 3 hares and 2 pheasants in their food. The first complete data on Imperial Eagles' food were published much later by Haraszthy

et al. (1996). In comparing almost identical sizes of *A. heliaca* food samples from three areas of the Pannonian Basin (Table 5) with our Slovakian ones, we can see some marked differences. In the population from Western Slovakia the numbers of hunted birds (Aves) are higher, but especially certain species of small animals: hare (*L. europaeus*), pheasant (*P. colchicus*), partridge (*P. perdix*) and magpie (*P. pica*). Pigeons (*C. livia dom.*) were an important component of the food. In the East Slovakian population the incidence of prevalent species (*L. europaeus* and *C. cricetus*) is similar to the average in Pannonia. Compared with that average, however, there is more numerous incidence of some subdominant species in the food: hen (*G. gallus dom.*), rook (*C. frugilegus*) and raven (*C. corax*). The data from Hungary (Haraszthy et al. 1996) feature more numerous incidence of original steppe rodent species: hamster (*C. cricetus*) and ground squirrel (*S. citellus*). Certain more numerous species of *A. heliaca* prey show the same relative incidence in the samples from the observed areas of Pannonia, in particular *C. capreolus*, *M. arvalis*, *E. concolor* and *F. catus dom.* Some data on the food of Imperial Eagles in Vojnatina in Northern Serbia were published by Pelle (1986). The principal component consisted of ground squirrels (*S. citellus*), but young rooks (*C. frugilegus*) appear there more frequently, and there was probably a local nesting colony from which the eagles snatched the young of long-eared owls (*A. otus*). In the Pannonian Basin *A. heliaca* is dependent for its food on hunting in intensively-farmed agricultural country. Steppe species of prey which are optimal in size (*C. cricetus* and *S. citellus*) are replaced with others whose density is influenced by farming and hunting activities (*L. europaeus*, *P. colchicus*, *P. perdix*, *C. capreolus*, and muskrat *Ondatra zibethicus*) as well as domestic animals (mainly *C. livia dom.*, *G. gallus dom.* a *F. catus dom.*).

In data on the food of *A. heliaca* from an area of natural steppes almost free of human influence in Georgia (Abuladze 1996), smaller rodent species are still prevalent (Rodentia, 54%). Birds are less frequent prey, but there is greater incidence of reptiles (Sauria, 30%). In the steppes of North Kazakhstan (Naurzumskij zapovednik, Zabarnyj 1968), in addition to the predominant water vole (*Arvicola terrestris*) 24%, the eagles hunt greater numbers of marmots (*Marmota bobac*) 16%. In the desert area near Lake Aral (Lobačov 1967), after tawny ground squirrels (*Citellus fulvus*) 60% the next most frequent prey were great gerbils (*Rhombomys opimus*) 29%.

Tab. 5. Comparison of food of *A. heliaca* in three areas of Pannonia, adapted table.
Tab. 5. Porovnanie potravy *A. heliaca* v troch oblastiach Panónie, usporiadaná tabuľka.

Species \ Region	ZS	VS	Maď	Suma	%
<i>Lepus europaeus</i>	+226	152	- 73	451	26.59
<i>Phasianus colchicus</i>	+ 97	- 44	71	212	12.50
<i>Columba sp.</i>	+ 67	43	- 21	131	7.72
<i>Pica pica</i>	+ 13	3	- 1	17	1.00
<i>Perdix perdix</i>	+ 9		1	10	0.59
<i>Gallus gallus dom.</i>	-- 1	+ 21	20	42	2.48
<i>Corvus corone+frugilegus</i>	8	+ 16	7	31	1.83
<i>Corvus corax</i>	1	+ 7		8	0.47
<i>Cricetus cricetus</i>	-- 65	145	+311	521	30.72
<i>Spermophilus citellus</i>	- 9	33	+ 45	87	5.13
<i>Ondatra zibethicus</i>	1	1	+ 9	11	0.65
<i>Capreolus capreolus</i>	12	10	11	33	1.95
<i>Microtus arvalis</i>	11	11	5	27	1.59
<i>Erinaceus concolor</i>	6	3	11	20	1.18
<i>Felis catus dom.</i>	4	6	3	13	0.77
<i>Anas platyrhynchos</i>	6	3		9	0.53
<i>Rattus norvegicus</i>	2	5	1	8	0.47
<i>Asio otus</i>	6	1	1	8	0.47
<i>Buteo buteo</i>	2		3	5	0.29
<i>Sus scrofa</i>	1	3	1	5	0.29
<i>Coturnix coturnix</i>	3		1	4	0.24
<i>Meleagris gallopavo dom.</i>	1	1	1	3	0.18
<i>Canis lupus fam.</i>		2	1	3	0.18
<i>Turdus sp.</i>		1	2	3	0.18
<i>Vanellus vanellus</i>	1	1		2	0.12
<i>Streptopelia decaocto</i>	1		1	2	0.12
<i>Falco tinnunculus</i>	1		1	2	0.12
Mammalia	339	374	474	1187	69.99
Aves	+223	148	- 136	507	29.89
Total	562	524	610	1696	100.00
H' diversity index	2.04	2.18	1.82	2.16	

Key:

+, - : positive and negative deviations from the mean value (Obuch 2001)

Species recorded in the food in only one area:

ZS (Western Slovakia): *Ovis musimon* 2, *Strix aluco* 2, *Larus ridibundus* 1, *Lullula arborea* 1, *Sturnus vulgaris* 1, *Coccothraustes coccothraustes* 1

VS (Eastern Slovakia): *Talpa europaea* 1, *Mustela nivalis* 2, *Anas platyrhynchos dom.* 1, *Cuculus canorus* 1, *Strix uralensis* 1, *Serpentes sp.* 1, *Pisces sp.* 1

Maď (Hungary): *Glis glis* 1, *Vulpes vulpes* 1, *Anser anser dom.* 1, *Pernis apivorus* 1, *Turdus merula* 1

Vysvetlivky:

+, - : kladné a záporné odchýlky od priemeru (Obuch 2001)

Druhy zaznamenané v potrave len v jednej oblasti:

ZS (západné Slovensko): *Ovis musimon* 2, *Strix aluco* 2, *Larus ridibundus* 1, *Lullula arborea* 1, *Sturnus vulgaris* 1, *Coccothraustes coccothraustes* 1

VS (východné Slovensko): *Talpa europaea* 1, *Mustela nivalis* 2, *Anas platyrhynchos dom.* 1, *Cuculus canorus* 1, *Strix uralensis* 1, *Serpentes sp.* 1, *Pisces sp.* 1

Maď (Maďarsko): *Glis glis* 1, *Vulpes vulpes* 1, *Anser anser dom.* 1, *Pernis apivorus* 1, *Turdus merula* 1

Organized protection measures

One of the direct consequences of the trend of gradually-increasing numbers of *A. heliaca* in Slovakia can be identified above all in the active and targeted management of protection carried out over a long period by the Group for Protection of Raptors and Owls in Slovakia (SVODAS) in cooperation with several branches of the State Nature Conservancy of the Slovak Republic.

It is not insignificant that both eagle populations in Slovakia are able in our agricultural conditions to find such amounts of appropriate food as are indispensable for their positive development. This is demonstrated by the fact that the population is growing year on year by several new nesting pairs. Several projects have been implemented using funds from domestic and foreign sources, most recently however mainly from the EU.

Since 2003 a wider partnership of cooperation between the organizations Raptor Protection of Slovakia (RPS, successor to SVODAS), SNC SR and Hungarian specialists from MME-Bird Life has produced the project named "Protection of the Imperial Eagle in the Slovakian part of the Carpathian Mountains".

Among the aims of the protection programme, the principal one is to bring influence to bear on the key processes of usage of the countryside, with regard to improving the feeding and reproducing conditions of Imperial Eagles. As a result of the demise of the pasturing method of countryside management, from 1980 onwards there was a critical decline in numbers of ground squirrels (*S. citellus*) in Slovakia. The great majority of their colonies in the foothills disappeared, and with them also the bonds established with the historical nesting sites of the pairs of *A. heliaca* in the mountains. The disappearance of the ground squirrels led to a significant loss of part of the eagles' food sources, intensified by the demise of important pasture and meadow biotopes. In several selected locations, therefore, their restoration has been undertaken in the interests of improving the numbers and diversity of animal species making up the Imperial Eagles' food sources.

Súhrn

Karpatská panva je oblasťou, kde sa vyskytuje čiastočne izolovaná populácia orla kráľovského, hniezdiaca na území Maďarska, Slovenska, severnej

časti Srbska a okraj rozšírenia v posledných rokoch zasahuje aj na územie Českej republiky a Rakúska. V Európe tvorí severozápadnú časť jej celkového hniezdneho areálu. Druh s najväčšou pravdepodobnosťou začal na území Slovenska hniezdiť približne v 40-tych rokoch minulého storočia. Boli publikované údaje o postupnom obsadzovaní vhodných hniezdných biotopov na západnom i východnom Slovensku. Zatiaľ sa potravou tohto druhu na Slovensku nikto systematicky nezaoberal a donedávna chýbali o tom údaje aj z územia Maďarska. O príčinách rozširovania areálu orla kráľovského v Strednej Európe písal Sládek (1959), ktorý uverejnil aj niekoľko prvých údajov o jeho potrave. Na hniezdisku v Tribčici boli nájdené zvyšky chrčkov, sýsľov, mladých zajacov, domácich holubov a bližšie neuvedené plazy. Na hniezdisku v Inovci boli zistené zvyšky zajaca, holuba plúžika a hrdličky poľnej. Na hniezdišti v Malých Karpatoch zistili dvakrát mladého zajaca a po jednom jarabicu a sliepku bažanta. V Košickej kotline bol pozorovaný orol pri love sýsľov. Mošanský (1956) našiel v žalúdku dospelého orla zobák a kosti jarabice. O požívaní mláďat myšiakov lesných na ich hniezde informovali Harvančík a Šnír (1987). Časť údajov publikovaná Dankom (1973) je spracovaná v tomto článku. Viac údajov o potrave orlov kráľovských na Slovensku sme v literatúre nenašli. Na južnej Morave našiel Horák (1998, 2000) v hniezdach orlov 5x chrčka, 3x mladého zajaca, 1x hranostaja a 1x malého hlodavca.

Metodika

Základné údaje o koristi *A. heliaca* sme získavali dvoma spôsobmi:

1. vizuálnym určením druhov ulovených živočíchov pri priamej kontrole hniezd
2. determináciou zvyškov koristi pozbieraných na hniezdach, alebo v ich blízkosti

V práci sme vyhodnotili údaje o potrave orla kráľovského (*Aquila heliaca*) dvoch oddelených hniezdných populácií na západnom a východnom Slovensku. Dáta sme skumulovali podľa hniezdných párov a podľa sezón. Nakoľko niektoré údaje boli málo reprezentatívne, pristúpili sme k zlučovaniu dát od párov, hniezdiacich v rovnakom orografickom celku (Tab. 1 a 3) a sezóny sme spájali do päťročných intervalov (pentád, Tab. 2 a 4). Potravné spektrá *A. heliaca* sme vyhodnotili metódou zisťovania výrazných odchýlok od priemeru (marked differences

from the mean - MDFM, Obuch 2001). Výrazné kladné (+) a záporné (-) odchýlky sú vyznačené v kontingenčných tabuľkách č. 1– 4, kde je poradie druhov koristi usporiadané podľa zaužívaného zoológického systému. V Tab. 5 sú diagnostické druhy usporiadané do blokov s kladnými (+) MDFM, ostatné druhy sú usporiadané podľa klesajúcej dominancie. Pod tabuľkou sú vypísané druhy s výskytom zaznamenaným len v jednej oblasti.

Výsledky:

Diverzitu a dostupnosť potravných zdrojov orlov kráľovských ovplyvňuje predovšetkým poľnohospodárske a poľovnícke využívanie krajiny, v ktorej sú situované ich lovné teritóriá.

Na západnom Slovensku systematicky sledujeme koristiť *A. heliaca* od r. 1978 kombinovanou metódou zaznamenávania koristi na hniezde a zberu osteologických zvyškov s ich následnou determináciou. Vyhodnotili sme materiál od 21 hniezdných párov (uvedený počet oproti súčasnosti je vyšší, lebo boli hodnotené aj páry na hniezdiskách, ktoré medzičasom zanikli), pričom najintenzívnejšie bola sledovaná potrava 6 párov *A. heliaca*, hniezdiacich v Malých Karpatoch. Do roku 2005 sme získali údaje o 562 kusoch koristi. Dominantnú zložku tvorili cicavce (Mammalia, 60,3 %, 11 druhov). Vtáky sú zastúpené menej početne, ale s väčšou druhovou diverzitou (Aves, 39,7 %, 22 druhov). Pri porovnaní potravy jednotlivých hniezdných párov, ale tiež po kumulácii údajov podľa orografických celkov (Tab. 1) zisťujeme značnú podobnosť v pomernom zastúpení potravných spektier len s malými odchýlkami od sumárneho priemeru. S najväčšou pravdepodobnosťou je to dôsledkom toho, že páry hniezdiace v pohorí zaletovali na lov do agrocenóz, rovnako ako páry hniezdiace priamo v agrocenózach. Dominantnou koristiťou *A. heliaca* na západnom Slovensku je zajac poľný (*Lepus europaeus*, 40,2 %, predovšetkým mladé jedince s nižšou hmotnosťou), po ňom nasleduje bažant (*Phasianus colchicus*, 17,3 %, predovšetkým mladšie jedince alebo sliapky, zvyšky kohútov sme nezistili), holub (*Columba livia domestica*, 11,7 %) a chrček roľný (*Cricetus cricetus*, 11,6 %). Menej početnými druhmi zistenými v potrave boli: straka (*Pica pica*, 2,3 %), srnec (*Capreolus capreolus*, 2,1 %), hraboš poľný (*Microtus arvalis*, 2,0 %), syseľ (*Spermophilus citellus*, 1,6 %) jarabica (*Perdix perdix*, 1,6 %), myšiarka ušatá (*Asio otus*, 1,1 %), kačica divá (*Anas platyrhynchos*, 1,1 %) a jež bledý (*Erinaceus concolor*, 1,1 %). Ostatné druhy (Mammalia, 5 druhov,

Aves, 16 druhov) sú náhodnou koristiťou *A. heliaca* s dominanciou pod 1 %. Výraznejšie vyššia afinita k loveniu strák (*P. pica*) bola zistená u jedného páru *A. heliaca* na Podunajskej rovine. Sysle (*S. citellus*) lovili len 2 páry z Malých Karpát, chrčky (*C. cricetus*) lovili vo vyššom počte páry z Považského Inovca. Pomerne vyrovnané je tiež zastúpenie druhov koristi pri vyhodnotení materiálu podľa pentád (tab. 2). Len bažant (*P. colchicus*) bol častejšie lovený v prvej fáze sledovania (do konca 80. rokov), syseľ (*S. citellus*) koncom 90. rokov, chrček (*C. cricetus*) a straka (*P. pica*) v posledných rokoch.

Potravu *A. heliaca* na východoslovenských hniezdiskách sledujeme od r. 1970. Vyhodnotili sme materiál od 30 hniezdných párov (uvedený počet oproti súčasnosti je vyšší, lebo boli hodnotené aj páry na hniezdiskách, ktoré medzičasom zanikli). Prevažujú údaje o prinesenej potrave na hniezdo a údaje o pozorovaniach úspešných útokov na koristiť. Potrava podľa orografických celkov je v tab. 3, podľa pentád v tab. 4. V údajoch o 524 kusoch potravy získaných do roku 2005 sú početnejšie cicavce (Mammalia, 71,4 %, 13 druhov) ako vtáky (Aves, 28,2 %, 15 druhov). Ojedinele boli zistené tiež plazy (Serpentes, 1 ex.) a ryby (Pisces, 1 ex.). Dominantnými druhmi v potrave *A. heliaca* boli zajac (*L. europaeus*, 29,0 %) a chrček (*C. cricetus*, 27,7 %). Ďalšiu početnejšou koristiťou bol bažant (*P. colchicus*, 8,4 %), holuby (*Columba* sp., 8,2 %) a syseľ (*S. citellus*, 6,3 %). Menej početne boli v potrave *A. heliaca* zistené domáce kury (*Gallus gallus domestica*, 4,0 %), havran (*Corvus frugilegus*, 2,7 %), hraboš (*M. arvalis*, 2,1 %), krkavec (*Corvus corax*, 1,3 %) a mačka domáca (*Felis catus domestica*, 1,2 %). Ostatné druhy (Mammalia, 8 druhov, Aves, 12 druhov, Serpentes a Pisces) sú zastúpené v potrave *A. heliaca* s dominanciou pod 1 %. Sysle (*S. citellus*) lovili hlavne páry hniezdiace v Slovenskom krase a v Košickej kotline, ale aj páry hniezdiace vo Volovských vrchoch ich lovili v týchto dvoch orografických celkoch. Sysle boli početnejšie zastúpené v potrave začiatkom 80. rokov, ale ojedinelé zistenia sú aj z posledných rokov. Vyššie zastúpenie chrčka (*C. cricetus*) na začiatku 70. rokov a v posledných 5 rokoch zrejme súvisí s ich dlhodobými gradačnými cyklami. Zistili sme špecializáciu 3 hniezdných párov na lov chrčkov: jeden pár z Volovských vrchov a druhý pár zo Slanských vrchov ich lovili v Košickej kotline, tretí pár ich lovil na Východoslovenskej rovine. Hraboš poľný (*M. arvalis*) bol početnejšie zastúpený u jedného hniezdného páru v Košickej kotline a zaujímavý bol nález min. 2 jedincov krkavca (*C. corax*) na hniezde páru

v Slanských vrchoch v roku 2005. Tento pár sa na krkavce špecializuje, pretože v jeho potrave sme krkavce zistili už aj v predchádzajúcich rokoch 1996, 1997 a 2001.

Porovnanie potravy *A. heliaca* v Panónskej kotline, Tab. 5.

Napriek tradícii a systematickému sledovaniu orlov v Maďarsku o ich potrave na tomto území niet takmer žiadnych publikovaných údajov. Tapfer (1973) uvádza, že v 60-tych rokoch podľa jeho pozorovaní lovili v 60-70 % sysle a 20-25 % chrčky. Zriedkavo nachádzal mladé zajace alebo kadávery, v jednom prípade z mladej domácej kačice. Bécsy (1974) pozoroval v rokoch 1971-1972 jedno hniezdo orlov, pričom v potrave zistil 8 chrčkov, 3 zajace a 2 bažanty. Prvé ucelené údaje o potrave orla kráľovského publikovali až neskôr Haraszthy et al. (1996).

Pri porovnaní takmer rovnako veľkých vzoriek potravy *A. heliaca* z 3 oblastí Panónskej kotliny (Tab. 5) vidíme niektoré výrazné rozdiely. U populácie zo západného Slovenska sú početnejšie lovené vtáky (*Aves*) a hlavne niektoré druhy malej zveri: zajac (*L. europaeus*), bažant (*P. colchicus*), jarabica (*P. perdix*) a straka (*P. pica*). Dôležitou súčasťou potravy sú holuby (*C. livia dom.*). U východoslovenskej populácie je zastúpenie dominantných druhov (*L. europaeus* a *C. cricetus*) blízke priemeru v Panónii. Oproti tomuto priemeru sú v potrave početnejšie zastúpené niektoré subdominantné druhy: kura (*G. gallus dom.*), havran (*C. frugilegus*) a krkavec (*C. corax*). Páry hniezdiace v susednom Maďarsku mali odlišné poradie dominantných druhov (Haraszthy et al. 1996): *C. cricetus* (51,0 %), *L. europaeus* (12,0 %), *P. colchicus* (11,6 %) a *S. citellus* (7,4 %). Početnejšie sú teda zastúpené pôvodné stepné druhy hlodavcov: chrček (*C. cricetus*) a syseľ (*S. citellus*). Niektoré početnejšie druhy koristi *A. heliaca* sú vo vzorkách z porovnávaných 3 oblastí Panónie v rovnakom pomernom zastúpení, najmä druhy *C. capreolus*, *M. arvalis*, *E. concolor* a *F. catus dom.*

Niekoľko údajov o potrave orlov kráľovských vo Vojnatine v severnom Srbsku publikoval Pelle (1986). Hlavnú zložku tvoril syseľ (*S. citellus*), častejšie nachádzali mladé havrany (*C. frugilegus*) a pravdepodobne v ich kolónii vybrali z hniezd aj mláďatá myšiárov (*A. otus*).

V Panónskej kotline je *A. heliaca* potravne závislý od lovu v intenzívne obhospodarovanej poľnohospodárskej krajine. Veľkosťou optimálne stepné druhy koristi (*C. cricetus* a *S. citellus*) sú nahrádzané

druhmi, ktorých denzita je ovplyvnená poľnohospodárskym a poľovníckym obhospodarovaním (*L. europaeus*, *P. colchicus*, *P. perdix*, *C. capreolus*, *Ondatra zibethicus*) a domácimi zvieratami (najmä *C. livia dom.*, *G. gallus dom.* a *F. catus dom.*).

V údajoch o potrave *A. heliaca* z územia málo ovplyvnených prirodzených stepí v Gruzínsku (Abuladze 1996) prevažujú menšie druhy hlodavcov (Rodentia, 54 %). Vtáky sú menej početnou korisťou, zato sú viac zastúpené plazy (Sauria, 30 %). V stepiach severného Kazachstanu (Naurzumskij zapovednik, Zabarnyj 1968) sú popri dominantnej kryse vodnej (*Arvicola terrestris*) 24 % početnejšou korisťou svište (*Marmota bobac*) 16 %. V púštnej oblasti pri Aralskom jazere (Lobačov 1967) boli popri sysľoch (*Citellus fulvus*) 60 % početnou korisťou pieskomily (*Rhombomys opimus*) 29 %.

Záver

Na západnom Slovensku sme od roku 1978 do roku 2005 zistili spolu 562 kusov potravy, ktorú tvorilo 33 druhov živočíchov. Dominantne boli v potrave zastúpené druhy *Lepus europaeus* (40,2 %), *Phasianus colchicus* (17,3 %), *Columba livia domestica* (11,7 %) a *Cricetus cricetus* (11,6 %). Na východnom Slovensku sme od roku 1971 do roku 2005 zistili spolu 524 kusov potravy, ktorú tvorilo 30 druhov živočíchov s odlišnou dominanciou hlavných druhov koristi: *L. europaeus* (29,0 %), *C. cricetus* (27,7 %), *P. colchicus* (8,4 %) a *Columba sp.* (8,2 %). *A. heliaca* hniezdiace na Slovensku v dôsledku výrazného poklesu denzity stepných druhov hlodavcov, najmä *Spermophilus citellus* a *C. cricetus* sú potravne závislé predovšetkým na početnosti drobnej zveri (*L. europaeus*, *P. colchicus*) a holubov (*C. livia domestica*).

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Fig. 2. Nest of Imperial Eagle (*Aquila heliaca*) and its breeding territory in Eastern Slovakia. Photo: Š. Danko

Obf. 2. Hniezdo orlov kráľovských (*Aquila heliaca*) a ich hniezadne prostredie na východnom Slovensku. Foto: Š. Danko



3	4
5	6
7	8

Fig. 3 - 8. Breeding and hunting territories of Imperial Eagles (*Aquila heliaca*) in Western Slovakia.
Photo. J. Chavko

← - Location of eagle nests

Obr. 3 - 8. Hniezdne a lovné teritória orlov kráľovských na západnom Slovensku. Foto. J. Chavko

← - Umiestnenie orlieh hniezd



▲ ▼ Fig. 9, 10. Young of Imperial Eagle (*Aquila heliaca*) with different type of food (remains of 3 separate *C. cricetus*). Photo: J. Chavko

Obr. 9, 10. Mláďatá orlov kráľovských (*Aquila heliaca*) s rôznym druhom potravy (zbytky 3 jedincov *C. cricetus*). Foto: J. Chavko

▼ Fig. 11. Unusual prey in Imperial Eagle nest – young Wood Lark (*Lullula arborea*). Photo: J. Chavko

Obr. 11. Nezvyčajná korisť v hniezde orlov kráľovských – škovránok stromový (*Lullula arborea*). Foto: J. Chavko





▲ **Fig. 12.** Hamster (*Cricetus cricetus*) - frequent prey in Imperial Eagle nests. Photo: L. Šimák.

Obr. 12. Chrček (*Cricetus cricetus*) – častá potrava v hniezdach orlov kráľovských. Foto: L. Šimák.



◄ **Fig. 13.** Remains of food on the eagle nest - roe deer (*Capreolus capreolus*) and raven (*Corvus corax*). Photo: J. Chavko

Obr. 13. Pozostatky potravy na orlom hniezde – srnec (*C. capreolus*) a krkavec (*Corvus corax*). Foto: J. Chavko